which separate two crystals has to be determined experimentally and is different from crystal to crystal. The optimal solution will be when the highest spatial resolution, low detector dead time, and good separation of pileup events is achieved. The optimal solution is determined by changing the centroid calculation and the pileup separation real-time algorithm, together with the change on the length of the slits. For some fast crystals, the cut of the crystals (slits) is not necessary.

DE9 6/11/06

Please replace the paragraph on page 14, line ~~16~~ 26, beginning "It is generally accepted" with the following amended paragraph:

It is generally accepted by those practicing in the relevant art that primary source of poor PET efficiency resulting from lost photons results from inefficiencies in crystal detectors. While detector crystals do not have perfect stopping power and do not capture every photon in range, as measured by the industry and independent researchers, the operating efficiency of detector crystals has been demonstrated to be 80% to 95%. Thus, according to the industry, 80% to 95% of the photon incidences at a detector crystal are converted into electrical signals. By contrast, the inventor of the present invention has independently discovered that the efficiency of prior art PET electronic can be calculated at approximately 8% (discussed in greater detail below). Inefficient PET electronics is partially due to dead-time resulting from bottleneck (e.g., multiplexing of data from many lines to a single line, saturation on input, processing, saturation on output) present at any stage of the electronics. Another shortcoming of prior art PET electronics is saturation of the electronics at the output stage due to the limiting architecture of the coincidence detection circuitry. These and other shortcomings of the prior art have been overcome and the efficiency of PET devices improved by using a special massively parallel-processing system architecture with digital signal processing on each electronic channel in accordance with an exemplary embodiment of the present invention (step **102**). The presently described processing system architecture is ~~capability~~ capable of fully processing all data captured (no electronic system dead time), without saturating the electronic system and further has data exchange capability between neighboring processors. The presently described processing system architecture allows for the detection of more photons, more accurately. Moreover, by implementing the presently described processing system architecture and overcoming the inherent inefficiencies of the prior art, the architecture [[e]] allows for the detection of more photons and or the implementation of a simplified, more efficient coincidence detection circuit. The present architecture is described in greater detail below with respect to **FIGs. 4 - 8**.